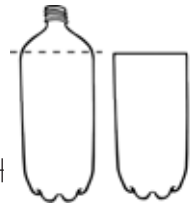
# 21. Read the Roots

**Objective:** Determine a watering schedule that encourages longer, deeper roots

**Time:** Session 1: 35 minutes; Session 2: 45 minutes; subsequent sessions: a few minutes every day for 12 days

**Materials:** 2-liter bottles (at least one per student), potting soil, ryegrass seeds, measuring spoons, water spray bottles, permanent marker, measuring cup, water, paper, pencils

***Note:*** *If time and supplies allow, the students can each make their own 2-liter containers to experiment with. A few weeks before this activity, ask the students to bring in empty, rinsed and clear 2-liter plastic bottles with the labels removed. Before the lesson, use a utility knife to cut the bottles as shown at right.* [•] *One bottle will be needed for each student conducting the experiment.*



Give one ryegrass seed to each student. Have the students guess what it is. Once they determine that it is a seed, ask them to guess what would grow from it.

Some lawns are made up of little plants that grew from millions of tiny seeds like the ryegrass seed they are holding. Ask the students what they think the plant growing from this seed would look like. Have the students make a life-size sketch of a ryegrass seed in the center of a sheet of paper. Next they should draw in their estimation of the roots and grass blades that would grow from a single seed.

Point out that the size of a plant's roots and leaves can depend greatly on the surrounding environmental conditions. To have a healthy lawn, one thing you must do is water the grass adequately during dry periods.

Ask the students which is a characteristic of healthy, strong grass: deep roots or shallow roots? Explain that in all plants, longer roots provide the following benefits:

- Stabilize the plant
- Enable the plant to find moisture at greater depths
- Provide more endurance during drought

So how do you help a plant grow longer roots? Tell the students that they will experiment to help those tiny seeds grow roots several inches long.

If supplies allow, the students could choose partners and complete this experiment in pairs; if not, demonstrate the following steps:

## Session 1

1. Fill two 2-liter bottles (spouts removed) with potting soil and pack it down firmly. Fill both containers to 1 inch from the top. Level the top of the soil to create an even surface.
2. Sprinkle 2 tablespoons of ryegrass seed in a uniform layer over the top of the soil. Cover the seed with 2 tablespoons of additional potting soil.
3. Use a water spray bottle to spray 30 milliliters (about ⅛ cup) of water evenly over the surface of each bottle to sufficiently wet the seed.

Tell the students that these containers represent a small section of two different lawns. So far, the two are identical, but in a few days the students will begin different treatments to learn how to grow longer, deeper roots. Lead the group in brainstorming about what these treatments might be.

Explain that the class will experiment with growing those longer roots by using water. Although each container will receive the same amount of water, the students will apply the water differently to each one.

Container receiving 30 ml daily

Container receiving 120 ml every 4 days

**Session 2** (after the grass seed begins to germinate, about 3 days after Session 1)
Like all living things, plants require water. The *frequency* that a plant receives water can greatly affect the growth of its roots. If two plants are given identical volumes of water, the one that gets more frequent, shallow watering will grow shorter roots than a plant watered deeper and less often.

This experiment will test the effects of watering at varying degrees of frequency:

1. Use a permanent marker to label the bottles *1. Less frequent* and *2. More frequent.*
2. Use a spray bottle to apply 30 ml (about ⅛ cup) of water over the soil in Bottle 1. Apply the same amount of water every day for 12 days.
3. Use a spray bottle to apply 120 ml (about ½ cup) of water over the soil in Bottle 2. Apply the same amount of water every 4 days, for a total of three applications.

*Using a spray bottle to apply the water may be physically taxing, but it is essential to controlling the rate of absorption and movement of water in the containers.*

After 12 days, evaluate the two sections of grass. Discuss the following:

- **Did one of the containers have taller grass? Thicker grass?**
- **In which container were the roots longer? More of the longer roots? Thicker roots?**
- **What was the difference in the approximate average root length in the two bottles?**
- **What might have caused the difference?**

**Option:** The students could carefully remove the roots and grass from the containers and gently rinse away the soil. This would allow them to better evaluate the differences in the plants growing in both containers rather than just viewing the roots that are visible through the sides of the bottles.

After just 1 week of no watering after the experiment, the grass on the right displays the advantages of a deeper, thicker root system.

Gravity causes water to infiltrate the surface of the soil and percolate into it. Applied slowly enough, a larger volume of water will allow for deeper water movement into the soil than will smaller volumes applied more often.

Close the lesson by reiterating that deeper, less frequent watering produces healthier plants. Because the watering is not as frequent, less water is available at the ground surface. The roots will grow downward, following the water's movement. Because lawns and soil types vary, have the students complete the Root Zone Water Police activity in Chapter 8 to determine the exact amount of water a specific lawn should receive.

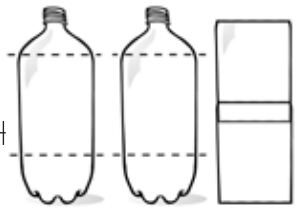
## Extensions

**Science:** A ryegrass seed is about ¼ inch long. How long a root could such a small seed produce? Have the students estimate and then find out.

The longest roots will grow in loose, sandy soil. Ask the students to assemble an elongated bottle as shown below and fill it with a mixture of potting soil and sand. Sow the seeds as before and water them thoroughly.

Point out that because the sandier soil cannot retain moisture as well as the plain potting soil, the students will have to monitor the cylinder and water more often as needed. Observe any differences in root length.

To further extend the experiment of growing the longest roots, have the students create a Read the Roots Cylinder but also cut away the base. [•] They will set the open cylinder in a pan, fill the cylinder with soil, and plant a layer of seeds at the top.



After an initial watering to allow the seeds to germinate, have them continue the experiment by watering only from the bottom of the container. The capillary action will pull water up into the soil, encouraging the roots to move even deeper to access the water.